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TRIBUTE TO DECEASED FELLOWS OF THE ROYAL SOCIETY[1]

By Sir WILLIAM BRAGG, O.M.

THE PRESIDENT OF THE ROYAL SOCIETY

THE year which has passed since our last anniversary meeting is sadly distinguished by the heavy losses which death has brought upon our society.

First and most conspicuous is the death of our revered patron, His Majesty, King George V. With all his peoples we mourn the close of a life devoted to the cause of peace and progress. As members of our society we feel deeply the loss of a patron who was a true friend to the purposes for which our society exists.

By the death of Richard Tetley Glazebrook, at the age of eighty-two years, we lose one of the most active and efficient scientific workers and organizers of his generation. Glazebrook began his scientific career under Clerk Maxwell and the late Lord Rayleigh at the Cavendish Laboratory. His first investigations were on double refraction. In the early eighties he became interested in the absolute determination of the electrical units, which continued to occupy him up to the very end of his life.

He was for a time senior bursar of Trinity and then principal of Liverpool University, but on the establishment of the National Physical Laboratory in 1899, Glazebrook was appointed the first director, and the present prosperity and national importance of that institution are more due to him than to any other single man. It remains as an abiding monument of his life's work. His retirement in 1919 by no means marked the close of his activities. As chairman of the Aeronautical Research Committee and of the Executive Committee of the laboratory, he was still able to

[1] From the Anniversary Address of the President of the Royal Society of London, given at Burlington House on November 30.

do much to promote the work to which he had devoted his best years. He was elected to the society as early as 1882, and received the Hughes Medal in 1909 and the Royal Medal in 1931. He was created K.C.B. in 1920, and received numerous other honors. The debt which the country owes to him in the development of aeronautics is very great.

Percy Carlyle Gilchrist was associated with his cousin, the late Sidney Gilchrist Thomas, in experiments which ultimately led to the establishment of the basic Bessemer process. Bessemer had discovered in 1855 that a stream of air when blown through molten pig iron contained in a converter removed its carbon and silicon by oxidation, the heat evolved being sufficient to retain the metal in a molten condition. The metal thus produced was brittle, owing to its oxidized condition. Within a year Mushet made the important discovery that if manganese was added to the molten metal in the form of ferro-manganese it removed the absorbed oxygen and enabled sound malleable ingots to be cast. These discoveries led to the establishment of the "acid" Bessemer process in which the lining of the converter is a siliceous refractory material. But phosphoric irons were not amenable to this treatment, since with an acid lining the phosphorus remains in the finished steel and renders it brittle.

In the early seventies Thomas conceived the idea of lining the converter with a basic material and making additions of lime with a view to eliminating the phosphorus in the converter. After preliminary experiments he enlisted the help of his cousin, P. C. Gilchrist, who was then a chemist at Cwm Avon in South Wales. Experiments were continued at these works, and Thomas and Gilchrist took out two patents. They were greatly assisted in their work by Mr. Martin, of the Blaenavon Steel Works, who came to their assistance, and on March 6, 1878, another patent was taken out. After this, progress was rapid, and at the autumn meeting of the Iron and Steel Institute, held that year in Paris, they presented a paper entitled "On the Elimination of Phosphorus in the Bessemer Converter." The paper was not read at this meeting and was adjourned until the following one in 1879, when it was read by Thomas and published in the journal of the Institute. In this way the basic Bessemer process was established and has proved to be one of the main processes for producing cheap steel on a large scale.

Stewart Ranken Douglas was deputy director of the National Institute for Medical Research and director of the Department of Experimental Pathology and Bacteriology. He will always be remembered for his work, in association with Sir Almroth Wright, on opsonins and vaccines. The discovery of opsonins was communicated to the society in 1903, a second communication followed early in 1904, and further work on these subjects during the following decade laid the foundations of vaccine therapy as it is practised to-day. Douglas devised several valuable nutrient culture media for pathogenic bacteria, and one of these proved invaluable during the war, for it enabled large quantities of vaccines to be made for the army at a time when the constituents of culture media as then compounded were becoming difficult to procure. After the war, Douglas organized the new pathological laboratories at the National Institute for Medical Research and devoted himself to the initiation of new lines of research and the encouragement of his juniors. He was largely responsible for planning and directing the scheme of study of virus diseases at the institute which proved so fruitful. Although the publications under his name in this branch of knowledge are few, he inspired and guided much of the work published by his juniors. He was elected to the fellowship of the society in 1922 and to the fellowship of the Royal College of Physicians in 1933.

James Hartley Ashworth was a distinguished zoologist and acquired a wide reputation as a teacher, more particularly in that branch of the subject which is usually referred to as medical zoology.

In the early part of his career he made an important contribution to our knowledge of the Alcyonaria and afterwards turned his attention to the anatomy and systematics of the lug-worms (Arenicolidae). His elaborate investigation of the histology of the nervous system of these worms and the distribution of the giant-cells it possesses yielded results of great interest and importance.

Soon after his appointment to a lectureship in the University of Edinburgh, he was invited to provide a course on medical zoology for post-graduate students. As it was the first course of this kind to be given in this country, it was difficult at first to obtain a sufficient supply of specimens to illustrate his lectures; but with characteristic energy and skill he soon remedied the deficiency. In a few years the course acquired a wide reputation and attracted a large number of young medical men.

In connection with this class, original research was encouraged and stimulated, his own great monograph on the organism *Rhinosporidium,* which causes a polypus in the nose, being a contribution to our knowledge of outstanding importance.

Professor Ashworth will also be long remembered for the energy he displayed in obtaining the necessary funds for the magnificent new Zoological Laboratory in Edinburgh which now bears his name, and also for the wide knowledge and skill that he showed in expressing his wishes to the architects of that great building.

Professor Ivan Petrovitch Pavlov, best known of Russian men of science and greatest of Russian physi-

ologists, died on February 27 last at the age of 86. He had been a foreign member since 1907, was Copley medallist in 1915, and Croonian lecturer in 1928. He was Nobel laureate in 1904.

Pavlov was the son of a village priest and the grandson of a priest, and throughout his life, in spite of fame and position, he kept the simplicity of his origin, and in his teaching some of the attributes of the priest. He preserved his vigor to the end, and in August, 1935, presided over an International Congress of Physiologists which his prestige, and the affection of physiologists for him, had brought to Leningrad. His position in Russia was unique among scientific men and unique in public estimation. The attention paid to science in the Soviet Union is due, to a significant extent, to Pavlov's character and achievements.

Pavlov's earliest researches were on the physiology of the circulation, and in that work he realized, as Starling said of him, the necessity of avoiding if possible disturbing factors such as anesthetics, pain and discomfort, in experimental work on the normal functions of the body. From 1888 to 1900 came his great work on digestion, particularly on the nervous control of digestion. From 1902 onwards Pavlov and his pupils dedicated themselves to the problems of the higher nervous processes in the brain. The whole subject of "conditioned reflexes" was developed by Pavlov during that period. His demonstration that intelligent behavior in animals is built up largely of conditioned reflexes, just as skilled movement is the integration of simpler reflexes, although its consequences may often have been exaggerated by others, will remain one of the fundamental contributions to the physiology of the brain.

Pavlov remained an inspired and inspiring teacher to the end. A few weeks before he died he wrote a "Bequest to the Academic Youth of his Country," which gives vividly the philosophy of his experimental work: "Never attempt to screen an insufficiency of knowledge even by the most audacious surmise and hypothesis. Howsoever this soap-bubble will rejoice your eyes by its play, it inevitably will burst and you will have nothing except shame." "Perfect as is the wing of a bird it never could raise the bird up without resting on air. Facts are the air of a scientist. Without them you never can fly. Without them your theories are vain efforts." "Do not allow haughtiness to take you in possession. Due to that you will be obstinate where it is necessary to agree, you will refuse useful advice and friendly help, you will lose the standard of objectiveness." "Remember that science demands from a man all his life. If you had two lives that would be not enough for you. Be passionate in your work and your searchings."

With Pavlov died one of the greatest of our foreign members, one of the greatest teachers and investigators in physiology, and a very good and simple man.

Professor Conwy Lloyd Morgan, who died at the age of eighty-four years, entered the School of Mines with a view to becoming an engineer: here he came into contact with T. H. Huxley, under whose stimulating influence he acquired a deep interest in biology. After occupying a post in South Africa, he was appointed lecturer on geology and zoology at University College, Bristol, succeeding Sir William Ramsay as principal of the college in 1887. He had long had a deep interest in psychology and philosophy, and his sound scientific training well fitted him to take a broad synoptic view of the problems of life and mind. His researches on comparative psychology, especially on birds and dogs, were directed particularly to the segregation of innate and acquired factors in early behavior and are of permanent value in the development of a truly scientific psychology, founded upon a sound biological basis. In his later years he built up a philosophy of emergent evolution.

George Thurland Prior, distinguished as a mineral chemist and a well-known authority on meteorites, was elected a fellow of the society in 1912. He was born at Oxford in 1862 and, after a school and university education there, he entered the Mineral Department of the British Museum in January, 1887. There he did his life's work. In 1909 he succeeded Sir Lazarus Fletcher as keeper of minerals, and on reaching the Civil Service age-limit he retired in December, 1927, after over forty years of service.

In addition to his work as curator of large and growing collections and to the labor involved in determinations and reports on specimens submitted to the museum, he made many investigations on minerals, rocks and meteorites. Many new minerals were based on his careful analytical work, often done on very small amounts of material. He excelled in the difficult analyses of minerals containing niobium, tantalum, titanium, zirconium and the rare earths; and problems relating to these were often referred to him by workers in other countries. One of these minerals, a titanoniobate of yttrium and cerium earths from Swaziland, which he had analyzed, was named priorite after him by W. C. Brøgger, a foreign member of the society. His petrographical work included descriptions of the rocks collected by the Antarctic expeditions of Ross (1839–43), Borchegrevink (1898–1900) and Scott (1901–04), and of alkali-rocks from Abyssinia and East Africa. In his work on meteorites he described many new falls and devised simpler methods for the partial analyses of others previously known. From his results he was able to show that "the richer in nickel is the nickel-iron, the richer in ferrous iron are the magnesium silicates." This may well be called Prior's law. On it he based a new genetic classifica-

tion of meteorites. His "Catalogue of Meteorites" is the standard work of reference. Dr. Prior was for eighteen years the general secretary of the Mineralogical Society and its president in 1927–30.

To the physiologist the name of John Scott Haldane will always be associated with that masterly investigation of the respiration which was his outstanding contribution to pure physiology, for this has played a remarkable part in moulding the change of outlook in physiological thought which has been apparent since the beginning of the present century. Deeply interested in a philosophy of life which guided, and was in turn guided by, his own experimental researches, he has made clear by his work the exquisite and quantitative coordination of the different functions of the body on which the integrity of the living organism depends, and the delicate adaptive changes which are characteristic of life. By the introduction of new experimental methods and the design of special apparatus, he has shown how it is possible to use delicate methods of chemical and physical analysis to gain an insight into the physiology of the intact and normal human being. Far-seeing and original in his ideas and courageous in maintaining his views, his work ranged over a far wider field than academic physiology, for he drew no distinction between pure and applied science but found inspiration for his work in both alike. Much of his time and thought was devoted to investigations whose object was the reduction of the risks which the miner has to run in the course of his daily occupation, and the elimination of the diseases and discomforts associated with mining or with other occupations when men have to face foul air or extremes of temperature. By the application of strict scientific methods he has rendered negligible the dangers which were formerly associated with deep diving and work in compressed air. Great as were his contributions to physiology his investigations in the field of general industrial hygiene were no less important and fruitful.

Percy Fry Kendall was born in London in 1856. He began his geological studies at evening classes, and in the early eighties took the full course at the Royal College of Science, South Kensington. He then went to Manchester as a Berkeley fellow of Victoria University. His life's main work was the building up of the School of Geology at Leeds. Starting under difficult conditions as a part-time lecturer at the Yorkshire College in 1891, his teaching attracted students to his classes and brought prestige to the college, so that when Leeds University received its charter in 1906, he became the first occupant of the chair of geology.

Among geologists, Kendall will be remembered as the great protagonist of glaciation of Britain by land ice. He was the central figure in the organization of local workers who, through a British Association committee, made systematic records of the dispersion of glacial boulders. An outstanding contribution to natural knowledge is the demonstration of ice marginal retreat stages round the British hills, which was started with his publication in 1902 on "The Glacial Lakes of Cleveland" in the *Quarterly Journal of the Geological Society*.

From about 1900, Kendall's attention was directed to the supply of underground water for Yorkshire towns and villages, and so to the problems of the coalfields. For the Royal Commission on Coalfields in 1905 he produced a masterly report, documenting the local application of the doctrine of posthumous folding and estimating the unproved area of the Yorkshire, Nottinghamshire and Derbyshire coalfield at 3,885 square miles.

Professor Kendall was awarded the Lyall Medal of the Geological Society in 1909. He retired from the chair at Leeds in 1922 and was granted the title of emeritus professor. He was elected into this society in 1924, and received the honorary degree of D.Sc. at the coming of age of Leeds University in 1926. He died at Frinton-on-Sea in March, 1936.

By the death of Sir Archibald Garrod, the society loses a fellow who, while primarily an investigator, became famous as a practising physician and pathologist. He was trained in medicine at St. Bartholomew's Hospital. Early in his career he was attracted by the subject of urinary pigments and published papers on haematoporphyrin, urochrome uroerythrin and urobilin. His work on alkaptonuria was of primary importance: he saw in it not a disease but an individual variation; these and other studies led to the publication of his book on "Inborn Errors of Metabolism" in 1909. His professional career absorbed much of his time, and left him little leisure for personal research, though his sympathies and interest were a direct stimulus to much valuable work while he was regius professor of medicine at Oxford from 1920 to 1927. He was elected a fellow in 1910 and was a vice-president from 1926 to 1928.

Sir Joseph Ernest Petavel was born in London in 1873, spent his early years at Lausanne, where he studied engineering and returned to England in 1893 to continue the study of his subject for three years at University College, London. For the next three years he worked in the Davy Faraday Laboratory of the Royal Institution on the properties of matter at low temperatures, on the emission of light and heat from carbon and platinum with the object of obtaining a standard of light; there also he devised the well-known "Petavel gauge" for measuring the rate of rise of pressure in explosive reactions.

Proceeding to Manchester University in 1901, he lectured on mechanics and meteorology and applied his conspicuous gift for design to the evolution of a

new technique for work at high pressures and temperatures. This had an important influence on the study of ballistics and of combustion and on the industrial development of chemical reactions under the above conditions. He became professor of engineering there in 1909.

Through his interest in the problems of the upper air, he came into touch with aeronautics and in the early days of the war supplied a definite stimulus to the study of aerodynamics, resulting in improvement in the stability of aeroplanes. His fertility in design was also employed in other work for the Admiralty and the War Office.

In 1919 Petavel succeeded Sir Richard Glazebrook as director of the National Physical Laboratory and gave his undivided attention to the extension of its activities and especially to the increase of its usefulness to industry.

Petavel will be remembered not only for his achievements in pure science and in administration but also for his personal qualities, his courtesy, hospitality and love of his house and gardens, for the upkeep of which he expressed a wish that a contribution should be made from his bequest to this society.

Professor Karl Pearson, Galton professor of eugenics at University College, London, from 1911 till his resignation in 1933 at the advanced age of 76, died suddenly on April 27. Elected to the Goldsmid professorship of applied mathematics at University College in 1884, he began the statistical work with which his name is chiefly associated about the year 1891, his first statistical memoir being printed in the "Philosophical Transactions" of 1894. From then onwards there followed an ever-increasing mass of work at first largely in our "Transactions" and "Proceedings," later mainly in the journal *Biometrika,* which he founded in 1901, work which may well be said to mark a new epoch in the history of statistical method. Pearson was not only himself an indefatigable worker, but an outstanding teacher with a great capacity for rousing enthusiasm in others, and his pupils are scattered all over the world. But he was not only a statistician; he wrote on other branches of applied mathematics and in earlier years edited and completed Todhunter's "History of the Theory of Elasticity." This, the well-known "Grammar of Science," the "Life of Francis Galton" and several of the essays in "The Chances of Death and other Studies in Evolution" fall within the field of science. An early little book on the Veronica legend and portraits of Christ, and the essays of "The Ethic of Freethought" show the scholar, historian and philosopher. Elected a fellow in 1896, Pearson was awarded the Darwin Medal in 1898, but never took any active part in the general work of the society.

Alfred Cardew Dixon, who died on May 4 last at the age of 70, was senior wrangler in 1886, fellow of Trinity and afterwards professor of mathematics successively in Queen's College, Galway, and the Queen's University of Belfast. Like most Cambridge mathematicians of what is now the older generation, his interests extended over a very wide domain in the science, and at different times he published original papers on geometry, analysis, dynamics and the theory of elasticity. Among his best-known achievements may be mentioned his theory of the singular solutions of systems of differential equations of any order; his papers on the integration of partial differential equations; his great memoir of 1901 on matrices of infinite order—a subject in which he was a pioneer, and a subject now of great importance in the last decade on account of its applications in quantum mechanics—and the researches of his later years on the theory of integral equations and the problems of the elastic plate. As a teacher and administrator he was most highly regarded in the University of Belfast, which conferred on him the honorary doctorate of science. After retirement from his chair in 1930, he settled near London and took an active part in the affairs of the London Mathematical Society, of which he was president in 1932–33.

Sir George Hadcock, a fellow of the Royal Society since 1918, was a man of great charm of manner, and was much liked by all with whom he came in contact.

His extensive experimental work in connection with the development of artillery in all its phases was largely responsible for the present position of the science of gunnery and ballistics; and his "Ballistic Tables," published in 1897, were for many years the official tables of the War Office to be used in conjunction with the "Text-book of Gunnery."

Hadcock conducted experiments to determine the effect on the resistance of thick-walled cylinders to internal pressure, which were some of the first to be carried out in this country; and upon them our present knowledge of overstrain in metals is largely based.

He was the author of several books and many papers on artillery and ballistics, and wrote articles on these subjects for the "Encyclopædia Britannica." He also contributed a paper, which was published in the "Proceedings of the Royal Society," on the "Longitudinal Strength of Cylinders, etc."

Professor William Ernest Dalby, emeritus professor of engineering in the University of London, died on June 25, 1936, at the age of seventy-two years. At the early age of fourteen he commenced his practical training at the Stratford Works of the Great Eastern Railway. Then having been awarded a Whitworth scholarship he went to the Crewe Works of the London and North-Western Railway. In 1891 he accepted an invitation from Professor Ewing to act as his assistant and from that time onwards his career ran along academic lines.

After six years with Ewing, Dalby was appointed to a professorship of engineering at the Finsbury Technical College, where he remained from 1896 until 1904, when he was promoted to the chair of civil and mechanical engineering at the City and Guilds College at South Kensington. This professorship of London University he retained until his retirement from academic work in 1931. Although Dalby in nowise neglected or belittled his duties as a teacher, his interests were mainly concentrated on research, particularly research of a practical variety. His researches were very varied and, with the exception of the electrical, dealt with almost every branch of engineering knowledge. When at Finsbury the research which monopolized his attention was concerned with "Balancing of Engines." On this subject he became recognized as the highest authority. It was his first love in research and it is the one with which his name will continue to be associated by future generations of engineers. Elected a fellow in 1913, he served on the council during the year 1924. Hard-working, conscientious and conspicuously generous minded in his estimate of others, he leaves behind him the pleasing memory of a man who without motive invariably gave the best that was in him to the cause of engineering science and the betterment of engineering education.

Richard Dixon Oldham, who died on July 15, 1936, at the age of seventy-eight years, spent twenty-five years of his active life of research as a member of the Geological Survey of India; and, after his retirement from official work in 1904, he continued to carry on, with marked distinction, his studies of seismology and physical geography. His work in India was mainly devoted to the regional geology, and especially the stratigraphy of Baluchistan, the Himalayas, Northern Peninsular India and the Andaman Islands. This wide range of field experience qualified him eminently for revising the official "Manual of the Geology of India," which was published in 1893.

In a paper, published in 1906, analyzing the seismographic records of fourteen world-shaking earthquakes, Oldham established the existence of two distinct sets of deep-seated waves, traveling at different speeds; and, from the way in which the waves of distortion were damped out in depth, he deduced the existence of a central core in the earth, four tenths of the radius in thickness, which contrasted in physical properties with the external shells. In this way Oldham pointed to the pretty analogy between seismic waves as a source of information regarding intratelluric conditions and those of light which, on analysis by the spectroscope, give information regarding the composition of the sun's atmosphere.

Oldham was elected a fellow in 1911 and served on the council of the society in 1920–21. He was also elected president of the Geological Society of London in 1920, and in 1931 an honorary fellow of the Imperial College of Science, in which he received his early training.

Sir Henry Wellcome, head of the great firm of Burroughs, Wellcome and Company, died in London on July 25, at the age of eighty-two years. Famous throughout the world for his commercial achievements, he attained still greater renown for his lifelong interest in medical science, to the promotion of which, in one or other of its branches, he devoted most of his energies and practically all his wealth.

After an early training in pharmacy and chemistry in America, where he was born, he came to this country and founded with Burroughs, in 1880, the firm which later passed into his sole control.

In 1894 in the early days of serum therapy, he grasped the possibilities of protective and curative sera and founded the Physiological Research Laboratories with the twofold object of bringing serological and biological remedies within the reach of medical men and their patients and of carrying out researches into the fundamental problems of immunology and allied subjects. Two years later he founded the Chemical Research Laboratories, and then in 1913 the Bureau of Scientific Research to carry out researches in tropical medicine and coordinate the work of the various research laboratories and museums he had founded. The museums included the Museum of Medical Science, depicting modern medicine in graphic form, and the Historical Medical Museum, illustrating, by a most extensive and priceless collection of instruments, objects and books, the history of medicine from the earliest times to the present day.

He built the Wellcome Research Institution in the Euston Road and established the Tropical Research Laboratories in Khartoum.

He made arrangements in his will for the continuance of his great business and of his various research laboratories and museums, all of which are now grouped under the name of the Wellcome Foundation. Over and above this, residuary profits are also to be devoted for the most part to the furtherance of scientific research.

Dr. Bernard Smith died on August 19, having held for only ten months the directorship of the Geological Survey of Great Britain and of the Museum of Practical Geology, London. He had served on the council of the Royal Society for nearly a year and was chairman of a committee on ordnance survey maps. For thirty years he had been a member of the Geological Survey. He had been since 1931 assistant to the director, and in charge of field work in England.

Smith was essentially a field geologist with a special bias to the study of the relations of physiography to geology. This was well shown by his published textbook of "Physical Geography," which is in its third

edition. His principal contribution to British geological science was his interpretation of the Whitehaven coalfield. This difficult ground was entrusted to him, and a staff of geologists working under his direction, in 1920, and the maps and memoirs are now nearly all published. The work maintained a very high standard and solved many problems previously little understood. Almost equally important was his investigation of the iron-ore deposits of West Cumberland and Lancashire, the principal sources of British hematite.

Smith's early death cuts short a career of great promise. His ability was shown in all his investigations and his judgment was cautious, sound and penetrating. With equal ease he handled a great variety of subjects and as a colleague and director he was universally esteemed. Gentle and unobtrusive in manner, he won the confidence of his colleagues and of the public, and, unspoiled by popularity and success, he exerted a stimulating influence on wide circles of British geologists.

Henry Louis Le Chatelier devoted almost the whole of a long and active life to physical chemistry in its applications to concrete problems, giving special attention in the later years to those of metallurgy. His early work on the dissociation of calcium carbonate led him to the enunciation of the "Le Chatelier principle," which indicates the influence of a change of external conditions on the state of a system in equilibrium. This principle has played a great part in the development of physical chemistry. His application of the theory of solutions to metallic alloys opened up a new field, which has proved very fertile. He was an excellent experimenter and introduced several new instruments, the most important of which was the thermo-electric pyrometer, universally used in the study of alloys. By his foundation of the "Revue de Métallurgie" in 1904 he provided a medium for the publication of French researches in metallurgy, which has ever since retained its position as a leading technical journal. The esteem in which he was held by scientific men of many countries was shown by the celebration in Paris of his academic jubilee in 1922. A graduate of the École des Mines and for many years one of its professors, he approached chemistry from the side of a mining engineer, and this fact determined his practical bias. Both by his teaching and through his important text-books he exerted a great influence on the development of chemistry and chemical industry in France. He was elected a foreign member of the Royal Society in 1913.

William Johnson Sollas, who was elected a fellow in 1889, died at the age of eighty-seven years, retaining undiminished his remarkable energy and many-sided interest in science. His researches not only illuminated his own special province of geology with mineralogy, but also included important contributions to zoology and anthropology, even, in his work on the "Age of the Earth," venturing into the domain of physics. He was educated at the City of London School and the Royal School of Mines, and wrote, not many months ago, his memories of student days under the inspired teacher T. H. Huxley, and of the group of friends who, led by the late Dr. William Garnett, migrated to Cambridge. After many years of teaching his subject in Dublin, he became in 1897, and remained until his death, professor of geology at Oxford, where the arrangement and great development of the university collections and the deepening interest in geological study will be long remembered as the fruits of his occupancy of the chair.

Sollas was formerly fellow of St. John's College, Cambridge (elected 1882), and became fellow of University College, Oxford, a few years after his election to the professorship. His election last year to the honorary fellowship of the Imperial College of Science gave him much pleasure. He was president of the Geological Society of London 1908–09, and was awarded a Royal Medal in 1914.

Professor George Forbes was a man of great versatility and was particularly interested in physics, astronomy and electrical technology. He was born in 1848. After graduating at Cambridge he was appointed, at twenty-three years of age, professor of natural philosophy in Anderson's College, Glasgow, which post he held until 1880. One of his chief pieces of physical work was a determination of the velocity of light by a modified Fizeau method carried out in conjunction with Dr. T. Young and described in "Philosophical Transactions" in 1882. The result obtained was a velocity of 301,382 kilometers per second. In 1874 he took charge of an expedition to Hawaii to observe a transit of Venus.

When incandescent electric lighting began commercially at about 1882, Forbes came to London to occupy a post in an electric manufacturing company and made improvements in arc lamps and electric meters. His chief contribution was the introduction of brushes for dynamo machines and motors made of hard graphite carbon; an improvement of general utility. When the great project of employing part of the water power of Niagara for generation of electric current was started, Forbes was appointed to superintend the work of the electric installation and plant erection at the site and acted as consulting engineer to the Cataract Company carrying out the work.

Forbes traveled extensively and was a correspondent of the *Times* during the Russo-Turkish war. He invented a naval gun sight and a military range-finder and was granted a Civil List pension in 1931 for his services.

He was elected a fellow in 1887 and was a Chevalier

of the Legion of Honor of France and an honorary member of the Franklin Institute of America. He died at Worthing in October, 1936.

With the death of William Arthur Parks on October 5, the society loses a great Canadian and a great scientist. He was born at Hamilton and graduated at the University of Toronto, in which he was afterwards professor of paleontology. He joined the geological staff of the university in 1893, and touched on nearly every aspect of geology during his career. His exploration of Northern Ontario broke new ground, and his report on the building and ornamental stones of Canada is well known. But his favorite subject was undoubtedly paleontology, and to the world outside Canada he will be remembered chiefly for his classical work on dinosaurs. He became director of the Royal Ontario Museum of Paleontology in 1913; in 1926 he became president of the Royal Society of Canada. He was elected to our fellowship in 1934.

Thomas Martin Lowry, professor of physical chemistry in the University of Cambridge, died on November 2, 1936, at the age of sixty-two years. In his early days he was a pupil of, and an assistant to, Professor H. E. Armstrong and laid the foundation of his lifelong studies on optical rotatory power by discovering the mutarotation of nitrocamphor and the stereoisomerism of a number of halogen derivatives of camphor. He traced the mutarotation of nitro-*d*-camphor to the passage of equilibrium of two constitutionally different forms of the substance, and showed that the rate of change of the one form to the other could be influenced by the addition of traces of catalytic agents. By much careful work he established that the presence of an amphoteric agent is a factor in bringing about the isomeric change. Thus, whilst the mutarotation of tetramethyl-*d*-glucose can be arrested in the hydroxylic solvent, cresol, and the basic solvent, pyridine, it proceeds very rapidy in a mixture of these two solvents. On the basis of this and much other work, Lowry founded his now well-known theory of prototropy, according to which the migration of a hydrogen ion, in compounds such as nitrocamphor and the sugars, depends on the addition and removal of a proton at opposite poles of the molecule. It is largely due to Lowry's work that the conception of dynamic isomerism advanced by van Laar became generally accepted.

Concurrently with his chemical work on mutarotation, Lowry took up the study of optical rotatory dispersion which had been much neglected since the death of Biot in 1862; he demonstrated the validity of Drude's equation for simple substances and showed that it also covered the anomalous rotatory dispersion of *d*-tartaric acid and the tartrates. This work formed the subject of the Bakerian lecture given by Lowry and Austin in 1921. His later very precise determinations of the rotatory power of quartz in the visible and violet provided valuable data by which the validity of the Drude equation was further extended.

Lowry later extended his studies of the rotatory power of transparent media to that of absorbent media, namely of the Cotton effect, and was able to develop equations which are adequate to express the dispersion throughout the absorption band. Whilst occupied with the study of optical rotatory power, Lowry carried on parallel lines of research; his earlier verifications of Drude's equations were combined with corresponding measurements of magneto-rotatory dispersion and, in his search for possible relationships between diverse optical phenomena, he carried out a series of investigations on the refractive dispersion of organic compounds.

(*To be concluded*)

SCIENTIFIC EVENTS

BRITISH GOVERNMENT GRANT TO THE ROYAL SOCIETY

AT the dinner given on the occasion of the 274th anniversary meeting of the Royal Society, London, Neville Chamberlain, chancellor of the exchequer, announced the intention to make a treasury contribution towards the establishment of an institute of chemotherapy. In the course of his address he said:

In order to show that the Government was not indifferent to the duty of one generation to carry on investigations, the result of which perhaps might benefit only the generations which would succeed it, he would like to say that only within the last week or so he had consented to give a grant of £30,000 a year towards the establishment of an institute of chemo-therapy. Perhaps when he said that that allocation was in response to a request from the Medical Research Council, backed up by the Department of Scientific and Industrial Research and supported by his colleague the Lord President of the Council, they would think that that was no spontaneous act but merely the more or less graceful yielding of a movable object to the pressure of an irresistible force. He assured them that he could bring good evidence to show that the object in question was not always movable and that to move it there must be internal as well as external force at work.

It was difficult to foresee all the possibilities of the new institute. Unfortunately all the money that he had to find could not be devoted to objects which were so agreeable to himself. It was an unhappy but necessary feature of the present situation that a large part of the Government's activities had to be devoted to the defence of the country. That activity was reflected in the sums which were allocated to research for defence.

This year they would be spending £3,800,000 upon this

subject, an increase of £1,300,000 over what they were spending two years ago. But a great part of that expenditure, as he was sure they would all know, although primarily made for the purpose of defence, would nevertheless have its effect on many departments of civil life. Under the heading of defence came money spent on the Royal Observatory, on the Meteorological Office, the hydrographic surveys of the Navy, and the construction and manning by the Admiralty of a non-magnetic ship for the purpose of observing magnetic variations. They might remember that improvements in the engines of warships, developments in the design of military aircraft, or the evolution of the military tank were all speedily translated into forms which added to the resources of civil life. In civil research proper the contributions from the Exchequer also continued to show a steady increase. Grants to universities and colleges in 1914 were less than £500,000. They now amounted to £2,300,000. That was exclusive of the sum that was being allocated to the post-graduate medical school. Ultimately the grant to that school would be made through the University Grants Committee when the school became a recognized school in the University of London. Contributions to civil research proper amounted to £1,660,000.

PUBLIC EXHIBITION AND LECTURES OF THE CARNEGIE INSTITUTION OF WASHINGTON

THE annual exhibition, lectures and radio talks relating to the research activities of the Carnegie Institution of Washington were held on December 12, 13 and 14. The exhibits, which illustrated the work of the various departments during the year, are given below:

The Present-Day Maya Indians of Yucatan, by the Department of Genetics, in cooperation with the Division of Historical Research and the Nutrition Laboratory.

Archeology of the Guatemalan Highlands, by the Division of Historical Research.

Pinocytosis—The Drinking of Fluids by Cells, by the Department of Embryology.

The March of Forests in Response to Changing Climate, by R. W. Chaney.

Protection and Use of a Primitive Natural Area at Point Lobos, California, by N. B. Drury and R. W. Chaney.

Recent Cave Explorations in the Southwest, by Chester Stock.

New Factors in Animal Metabolism, by E. G. Ritzman.

Exploration of the Earth's High Atmosphere with Radio Waves, by the Department of Terrestrial Magnetism.

Absorbing Material in Space, by the Mount Wilson Observatory.

Formation of Copper Ores, by the Geophysical Laboratory.

The Publications of the Institution, by the Office of Publications.

A program of radio talks was arranged as follows: "Carnegie Institution Researches," included in the news program of the U. S. Office of Education; "Early Man," by Chester Stock; "Supergravitation in the Atom," a round table led by Dr. W. F. G. Swann; "Advances of Science as Illustrated in the Annual Exhibition of Carnegie Institution of Washington," by President John C. Merriam and John B. Kennedy.

Public lectures on December 12 were opened with "Introductory Remarks" by Dr. John C. Merriam. He was followed by Ralph W. Chaney on "Why Our Forests Differ," and by Sinclair Smith on "The Local Group of Galaxies"; on December 13, lectures were given by Warren H. Lewis on "The Eating, Drinking and Locomotion of the Macrophages, the Great Scavenger Cells of the Body"; by John A. Anderson on "The Design of Large Telescopes," and by Chester Stock "On the Trail of Ancient Man in the Southwest." On December 14, H. A. Spoehr spoke on "The Point Lobos Natural Reserve," and E. G. Ritzman on "Genetic and Seasonal Factors in Metabolism."

THE UNION OF AMERICAN BIOLOGICAL SOCIETIES

A MEETING of the Council of the Union of American Biological Societies is called for 8:00 P.M., on Monday, December 28, in Room 104, Hotel Ambassador, Atlantic City. Professor Winterton C. Curtis, president of the union, writes:

> The question of future activities for the union will be considered, in addition to a report from *Biological Abstracts* and a report from a committee recently appointed to consider what can be done to remedy the conditions described in the address of Dr. Oscar Riddle, delivered as retiring vice-president of Section F of the American Association for the Advancement of Science in December, 1935 (SCIENCE, Vol. 83, January 17, 1936).
>
> The program that will be outlined by the latter report may prove sufficiently comprehensive to justify further action by the union.
>
> Election of new officers seems desirable to the present incumbents in view of circumstances that will be explained at the meeting.

If council members can not be in Atlantic City at the time indicated, it is hoped that such members will communicate promptly with the officers of their respective organizations in order that at least one representative of each society may be in attendance.

The meeting will be open to any biologist who may be interested and particularly to the officers of member societies, although official action must be by council members.

FRIDAY'S PROGRAM AT ATLANTIC CITY

SOME necessary changes have been made in the plan for the program of the general association meeting at Atlantic City on Friday, January 1, as originally out-

lined in the preliminary announcement (SCIENCE, November 27).

As originally planned, the morning will be devoted to the meetings of various committees, boards and similar organizations. The Secretaries' Conference, which includes in membership secretaries of all sections and affiliated societies, together with the officers of the association, will meet at 10 A. M. for their annual session. At noon this group will be tendered an official luncheon by the association. The luncheon will be closed promptly to permit members to participate in the afternoon program.

A demonstration symposium on "The Moving Picture in the Service of Science" will be held from 2 to 4 on Friday afternoon. Two sections will convene in separate rooms on the thirteenth floor of Haddon Hall.

In the Benjamin West room Dr. William Beebe will show reels on "Bathosphere Embryonic Eels and the Animation of Deep Sea Fish." This film was made under the auspices of the New York Neurological Society. This will be followed by Perry Burgess, president of the Leonard Wood Memorial, who will show the sound movie "Miracles in the South Sea." This is a sound drama of deep interest, portraying the bright side of the leper colonies on the shores of the China Sea.

The series in the Viking room starts with "Whaling for Science," by Professor E. M. K. Geiling, of the University of Chicago, and L. L. Robbins. Dr. Geiling will describe the general biology of the whale and his search for specimens of the pituitary gland.

This will be followed by a film entitled "A Health Educator with a Cine-Kodak in the Orient," by Dr. C. E. Turner, of the Massachusetts Institute of Technology. His motion picture in natural color deals with modes of life and scenic marvels in the countries visited. Brief comment concerning the problems of population and sanitation in these regions will accompany the film.

Following this, a film on "High Speed Motion Pictures of the Flight of Birds and of Bullets," by Dr. Harold E. Edgerton, of the Massachusetts Institute of Technology, demonstrates in striking fashion the significance of high-speed motion picture technique in making difficult measurements for scientific and engineering research.

At 4:30 in the Vernon room, Haddon Hall, will be given an address on "Changes and Modifications in the Conception of Carcinoma," by Dr. Walter Schiller, of the University of Vienna, Austria.

On Friday evening at 8:30 the association is to have a special private showing of "The Human Adventure," an eight-reel talking picture sketching man's rise from savagery to civilization. This film was produced under the direct scientific supervision of the late Dr. James Henry Breasted. The accompanying sound record contains in the second reel a record in Dr. Breasted's own voice.

Admission to the demonstrations will be by ticket, but complimentary cards may be obtained at the registration desk in Atlantic City.

HENRY B. WARD,
Permanent Secretary

SATURDAY'S PROGRAM AT PHILADELPHIA

ON Saturday, January 2, members of the association and its affiliated societies are invited to visit Philadelphia as the guests of The American Philosophical Society, The Academy of Natural Sciences and The Franklin Institute.

The train leaving Atlantic City at 8:10 A. M. reaches the Market Street Wharf, Philadelphia, at 9:10; one leaving at 8:25 A. M. reaches Market Street Wharf at 9:45. It is a short walk or ride from the foot of Market Street to the hall of the American Philosophical Society, 104 South Fifth Street. Here many historic records of the oldest scientific society in America will be on view. From 10 to 12 o'clock a series of papers on "Viruses and Virus Diseases" will be presented in the lecture room by some of the younger and more active workers in this field. This subject is one of the newest and most important in the whole realm of biology and medicine. Among the speakers on this occasion are Dr. W. M. Stanley and Dr. Ralph W. G. Wyckoff, of the Rockefeller Institute, Princeton, New Jersey, who will report on the crystallization of virus and its concentration by centrifugal force; Dr. Stuart Mudd, of the University of Pennsylvania Medical School, will speak on bacterial antigens and their preparation and preservation. Dr. Yale Kneeland, Columbia University Medical Center, will report on the virus of the common colds; Dr. George Berry, of the University of Rochester Medical School, on the transformation of the virus of one form of benign tumor into that of another malignant one.

At 12:30 a buffet lunch will be served in the hall of the society and at 2 o'clock visitors will be taken to the Academy of Natural Sciences at 19th Street and the Parkway and shown the new museum and the library, which is one of the best in its field in America. At 3 o'clock there will be a visit to the magnificent new building of the Franklin Institute at 20th Street and the Parkway. After inspecting the museums, laboratories and planetarium there, tea will be served to visiting scientists and their families at 4 o'clock. Those who wish to do so may visit other scientific educational or art institutes of Philadelphia, such as the Wistar Institute of Anatomy and Biology, the University of Pennsylvania, the University Museum, the Art Museum, etc.

The association is not scheduled to meet again in Philadelphia until 1942. It is hoped that many members may take this opportunity of seeing the recent developments in some of these oldest and most renowned scientific institutions of America.

RECENT DEATHS

DR. LOUIS M. DENNIS, for thirty-two years professor of chemistry at Cornell University until his retirement in 1932 as professor emeritus, died on December 9 at the age of seventy-three years.

DR. ARTHUR WITTER GILBERT, of the U. S. Department of Agriculture, died on December 7 at the age of fifty-four years. Dr. Gilbert was assistant professor and professor of plant breeding at Cornell University from 1909 to 1917 and Massachusetts State Commissioner of Agriculture from 1919 to 1934.

DR. CHARLES METCALFE BYRNES, associate in neurology at the Johns Hopkins Medical School, died suddenly on November 9. He was fifty-five years old.

THE death is announced of Dr. Edgar Hartley Kettle, professor of pathology in the British Post-Graduate Medical School of the University of London and consulting pathologist to St. Bartholomew's Hospital.

THE death is reported of Dr. Valdemar Henriques, director of the Rockefeller Institute of Copenhagen, formerly professor of physiology at the University of Copenhagen.

JUAN DE LA CIERVA, inventor of the autogyro, was killed on December 9 in an airplane accident at the Croydon Airdrome, England. He was forty years of age.

SCIENTIFIC NOTES AND NEWS

THE Charles Frederick Chandler Medal of Columbia University has been awarded to Dr. John Howard Northrop, member of the Rockefeller Institute for Medical Research, "for fundamental discoveries concerning bacteria, the constitution of protein and the chemistry of digestion." This is the sixteenth award of the medal. It will mark the centennial of the birth of Dr. Chandler. Dr. Northrop will deliver the Chandler lecture in the spring.

THE Associated Grocery Manufacturers Association of America, at their annual banquet in New York City on December 1 presented to Dr. George R. Minot, professor of medicine at the Harvard Medical School, its annual award "for research in the field of nutrition leading to the prevention of disease and the advancement of health." The selection of Dr. Minot was made by the following committee: Dr. George R. Cowgill, professor of physiological chemistry, Yale University, *chairman;* Dr. James S. McLester, Birmingham, Ala., past president of the American Medical Association; Dr. George W. McCoy, director of the National Institute of Health of the U. S. Public Health Service; Dr. Mary D. Swartz Rose, professor of nutrition, Teachers College, Columbia University, and Dr. Leonard A. Maynard, professor of animal nutrition, Cornell University. The presentation address was made by Dr. Morris Fishbein, Chicago, editor of the *Journal* of the American Medical Association.

MRS. MARY L. JOBE AKELEY received the gold medal for "distinguished achievement in exploration" of the National Travel Club at the annual dinner given in New York City on December 3. The silver medal was given to H. R. Ekins, of the Scripps-Howard newspapers, for "his distinguished contribution to the science of transportation and communication."

DR. CARLOS E. PORTER, director of the Zoological Institute of the University of Chile, founder and editor of the *Revista Chilena de Historia Natural,* has been awarded a gold medal in commemoration of his forty years of scientific work as editor of the *Revista.* A gathering was held in his honor on September 23 by representatives of the university and of the scientific and cultural societies of Chile. Dr. Porter was this year the recipient of a gold medal from the International Faculty of Sciences of London.

THE John Anisfield Prize of $1,000 of *The Saturday Review of Literature* has been awarded to Julian S. Huxley, secretary of the Zoological Society of London, and to Dr. Alfred C. Haddon, formerly reader in ethnology in the University of Cambridge, for their book, entitled "We Europeans: A Survey of 'Racial' Problems." The John Anisfield Award, established in 1934 by Mrs. Edith Anisfield Wolf, of Cleveland, in memory of her father, John Anisfield, is awarded annually "to encourage and reward the production of good books in the field of racial relationships, either here or abroad." The committee of judges consisted of Henry Pratt Fairchild, professor of sociology in New York University; Donald Young, of the Social Science Research Council, and Henry Seidel Canby, contributing editor to *The Saturday Review.*

AT the centennial convocation at Emory University the degree of doctor of science was conferred on Dr. Thomas M. Rivers, member of the Rockefeller Institute for Medical Research.

Industrial and Engineering Chemistry announces that of the men nominated by the local sections for officers of the American Chemical Society, the following have received the largest number of votes: *Presi-*

dent-elect, C. A. Kraus, E. Emmet Reid, H. S. Taylor and F. C. Whitmore; *Councilors-at-Large,* E. K. Bolton, R. A. Dutcher, W. L. Evans, Per K. Frolich, Edward Mack, Jr., C. E. K. Mees, Alexander Silverman and C. M. A. Stine.

THE American Society of Agronomy held its annual meeting in Washington, D. C., from November 17 to 20. Officers elected for the next year are: F. D. Richey, Bureau of Plant Industry, *president;* Emil Truog, University of Wisconsin, *vice-president;* Richard Bradfield, the Ohio State University, *chairman of the Soils Section;* O. S. Aamodt, University of Wisconsin, *chairman of the Crops Section;* J. D. Luckett, New York Agronomy Experiment Station, *editor,* and P. E. Brown, Iowa State College, *secretary-treasurer.* L. J. Stadler, University of Missouri, and G. W. Conrey, Ohio Agronomy Experiment Station, were selected to represent the society on the council of the American Association for the Advancement of Science in 1937.

DR. GEORGE B. PEGRAM, professor of physics at Columbia University, has been appointed dean of the Graduate School, the appointment to become effective on January 1. Dr. Pegram has been the acting dean of the school since the death of Professor McBain on May 7. He will head the non-professional graduate faculties, which include the faculties of political science, philosophy and pure science.

AT the Massachusetts State College at Amherst, John G. Archibald has been appointed research professor of animal husbandry; Dr. James E. Fuller, research professor of bacteriology; Dr. Emil F. Guba, research professor of botany, and Warren D. Whitcomb, research professor of entomology.

DR. R. S. POOR, professor of geology at Birmingham-Southern College, Alabama, has been appointed head of the department of geology. Dr. J. Allen Tower has been appointed assistant professor of geography.

AT the University of London the title of professor of applied physical chemistry has been conferred on G. I. Finch, in respect of the post held by him at the Royal College of Science; that of professor of pathology of mental disease in the university has been conferred on F. L. Golla, in respect of the post held by him at the Maudsley Hospital; that of professor of psychiatry in the university on Dr. Edward Mapother, in respect of the post held by him at the Maudsley Hospital, and that of reader in mathematics in the university on Dr. L. S. Bosanquet, in respect of the post held by him at University College. The title of emeritus professor of statistics has been conferred on Professor A. L. Bowley, on his retirement from the university chair of statistics of the London School of Economics.

HANS F. PRZYBYLSKI, of the National Grain Yeast Corporation, has been awarded the American Potash Institute fellowship in the department of agricultural biochemistry at the Pennsylvania State College.

DR. MARY COLLETT, associate professor of biology at Flora Stone Mather College of Western Reserve University, has received a grant from the Committee on Therapeutical Research of the Council of Pharmacognosy of the American Medical Association for material required for research on the effect of certain hormones on basal metabolism and general health conditions carried on under the direction of Dr. Torald Sollmann and Dr. Joseph T. Smith.

THE Medical School of the University of Oregon is the recipient of $400 from the council of the American Academy of Ophthalmology and Otolaryngology for the continuation of studies by Drs. Olof Larsell and Ralph A. Fenton on the relation between sinus infections and disease of the chest.

DR. EARL B. MCKINLEY, dean of the School of Medicine and professor of bacteriology, George Washington University, has been granted sabbatical leave for the second semester. He will leave in January for the Orient, where he will conduct research on leprosy under the auspices of the American Leprosy Foundation (formerly the Leonard Wood Memorial). Later, on traveling around the world, additional material will be gathered concerning the geographical distribution of disease for inclusion in a volume, to follow one recently published on the geography of disease, entitled, "A Cartography of Disease," now in preparation under a grant from the Carnegie Institution of Washington. Dr. McKinley will return to his post at the School of Medicine in September.

DR. HENRY B. WARD, professor emeritus of zoology at the University of Illinois, permanent secretary of the American Association for the Advancement of Science, gave on December 17 an illustrated lecture on "Salmon Psychology" before the Washington Academy of Sciences.

DR. W. F. G. SWANN, director of the Bartol Research Foundation, Swarthmore, Pa., spoke on December 11 before the New York University Chapter of Sigma Xi on "The Nature of Cosmic Ray Phenomena."

DR. HANS ZINSSER, professor of bacteriology at the Harvard Medical School, will give on January 22 at the Cornell University Medical College the annual Theobald Smith Memorial Lecture of the New York Society of Tropical Diseases. The title of the address will be "Rickettsia Diseases."

THE Thomas Vicary Lecture of the Royal College of Surgeons of England was given on December 10 by Dr. George W. Corner, professor of anatomy in the

University of Rochester. His subject was "Salernitan Surgery in the Twelfth Century."

DR. CHARLES H. KELLAWAY, director of the Walter and Eliza Hall Institute of Research in Pathology and Medicine, at Melbourne, Australia, delivered on November 27 a lecture on "The Peripheral Actions of Snake Venoms," at the Washington University School of Medicine, St. Louis.

DR. WILLIAM V. HOUSTON, of the California Institute of Technology; Dr. F. K. Richtmyer, Cornell University; Dr. George B. Pegram, Columbia University, and Dr. Henry G. Gale, University of Chicago, who were delegates to the Austin meeting of the American Association of Universities, delivered addresses before the recent Physics Colloquium at the University of Texas.

THE annual meeting of the Association for Research in Nervous and Mental Diseases will be held at the Waldorf-Astoria in New York on December 28 and 29. The program will be devoted to considerations of the pituitary gland. Among the speakers will be: Dr. Frederick Tilney, professor of neurology and neuroanatomy, Columbia University; Dr. Andrew T. Rasmussen, professor of neurology, University of Minnesota; Dr. Herbert M. Evans, professor of anatomy, University of California; Dr. Hector Mortimer, Montreal, Canada; Dr. Cyril N. H. Long, professor of physiological chemistry, Yale University, and Dr. James B. Collip, professor of biological chemistry, McGill University.

THE bacteriologists in Ohio met in Columbus on December 5 and organized an association. Papers were presented at the afternoon scientific session and Dr. C. A. Doan, Columbus, addressed the dinner meeting, speaking on "The Place of Bacteriology in Modern Medical Science." Dr. N. Paul Hudson, Columbus, was elected chairman of the association; Dr. Merlin L. Cooper, Cincinnati, *vice-chairman,* and Dr. W. A. Starin, Columbus, *secretary-treasurer.* It is planned to hold meetings semi-annually.

THE ninth annual Children's Science Fair of the American Institute, New York City, sponsored by the American Museum of Natural History, will be held in the Education Hall of the museum from May 9 to 16. Prizes amounting approximately to $3,000 will be awarded for individual school exhibits, school group exhibits, individual club exhibits and club group exhibits. Eighteen special prizes will also be awarded for winning displays. Exhibits may be entered in any one of the following ten groups: Stars and the solar system, earth studies, plant and animal life, biology, physics, chemistry, conservation, industries, history of science and special. Group exhibits may be entered by any school, the number of entries depending upon the register of the school. Each entry must be entirely the work of the students. Teachers may suggest ideas and sources of materials, and may offer criticism and instruction in technics, but they are not permitted to take part in the preparation of exhibit materials. Student science clubs may enter exhibits, as may individual students.

THE University of Pennsylvania has been authorized to continue the work of the George S. Cox Research Bureau in the study of diabetes for a further period of ten years by Judge Charles Sinkler in Orphans' Court. Judge Sinkler, adjudicating the account of the trustees, ordered them to continue payment of the income from the residuary estate to the trustees of the university for the purpose under the will.

SCIENTIFIC studies affecting New Jersey's dairy and oyster industries are planned by the Bureau of Biological Research of Rutgers University. It is reported that considerable losses incurred by the oyster industry as a result of the high death rate among young oysters may be checked as a result of research being carried on by Drs. Thurlow C. Nelson and James B. Allison. Other projects include studies of the spoilage and off-flavors of milk, the possibility of encroachment by the Spotswood pine-barren "island" on surrounding fertile areas, and the possibility of increasing the effectiveness of the pneumonia immunization serum. The bureau was established by the trustees of the university last May to coordinate the research of the eleven members of the departments in bacteriology, botany, physiology and zoology.

DISCUSSION

THE ACTION OF ESERINE AND PROSTIGMIN ON SKELETAL MUSCLE

ROSENBLUETH, Lindsley and Morison[1] reported that injections of prostigmin cause a decrease of the responses of cat's skeletal muscles stimulated indirectly by shocks applied to their motor nerves at regular intervals. Eserine led to inconsistent and slight effects in similar conditions.

Wilson and Wright,[2] on the other hand, have demon-

[1] A. Rosenblueth, D. B. Lindsley and R. S. Morison, *Am. Jour. Physiol.,* 115: 53, 1936.

[2] A. T. Wilson and S. Wright, *Quart. Jour. Exp. Physiol.,* 26: 127, 1936.

strated increased responses after prostigmin. Similarly Brown, Dale and Feldberg[3] also find a marked increase in the contractions to indirect stimulation after injections of eserine.

These apparent discrepancies are not due to the anesthetic employed, as Brown, Dale and Feldberg suggest; nor are they due to the site of injection of the drugs, as Wilson and Wright state. Whether increase or decrease of the responses occurs depends on the frequency at which the muscles are activated and on the dose of the substance injected.

In the same animal under dial anesthesia the contractions of the two gastrocnemius-soleus muscles may be recorded, while the popliteal nerves are stimulated, one at a frequency of 1 per 5 sec. and the other at a frequency of 3 or 4 per sec. If eserine (0.5 mgm per kgm) or prostigmin (0.1 mgm per kgm) is injected intravenously, the responses of the muscle stimulated at the lower frequency will increase, while those of the muscle activated at the higher frequency will, as a rule, decrease.

In general it may be stated that the conditions favorable for the appearance of increased responses are slow frequencies and small doses of the drugs; on the contrary, high frequencies and large doses lead to depressed contractions. The results are readily explained by the well-known ability of acetylcholine to stimulate skeletal muscle when in small doses, and to paralyze it when the concentrations are high. The acetylcholine in question is that liberated by the motor nerve impulses and protected from immediate destruction by the eserine or prostigmin which has been injected (*cf.* Cowan[4]).

R. S. MORISON
A. ROSENBLUETH

DEPARTMENT OF PHYSIOLOGY,
HARVARD MEDICAL SCHOOL

ON THE WORD SHADE–TREE

A SMALL pamphlet distributed by a prominent publishing company for the aid of authors in preparing manuscripts directs the writer, when speaking of trees, to "Make two words in all cases except where used as an adjective, when it is compounded, as: *apple tree, forest tree, fruit tree, etc.* Adjective form: *apple-tree borer, fruit-tree beetle,* etc." If entomologists followed this rule they would speak of *Empoasca fabae* as a leaf hopper or a leaf-hopper insect. As a matter of fact, the modern entomologist is so contrary that he does neither, a practice to which we shall refer later.

[3] G. L. Brown, H. H. Dale and W. Feldberg, *Jour. Physiol.*, 87: 394, 1936.
[4] S. L. Cowan, *Jour. Physiol.*, 86: 61P, 1936.

The Standard Dictionary discusses its method of compounding words at some length and states some general principles. In illustrating one of the principles, it says, "The second principle makes two nouns used together as one name become one word, if the first is not really attributive. Thus, while brick is attributive in *brick house* (a house made of bricks) it is *not* attributive in *brick-yard* (a yard in which bricks are made)." On page 1642 the Standard follows this principle and hyphenates *shade-tree*. The writer approves of this compounding because it gives a greater unification of sense in speaking of this particular kind of tree. Indeed, if any one is bold enough to write it as *shadetree,* similar to "shadbush," "sunflower" and "grasshopper," the writer will gladly follow suit.

It is of interest in this connection to recall for a moment the evolution of a word as an illustration of the growth of usage in writing the English language, at least in entomology.

The older usage is seen in a treatise on entomology in which *Eutettix tenella* is spoken of as the "Beet Leaf Hopper." Later entomologists call it the "beet leaf-hopper," while present-day authors speak of it as the "beet leafhopper."

I have often suspected that my ability to form mental pictures is not highly developed. At any rate, the broken words, "grass hopper," "grass-hopper," "leaf hopper," "leaf-hopper," "bed bug," "bed-bug," do not bring to my mind any such clear-cut, definitely circumscribed mental images as do the words "grasshopper," "leafhopper" and "bedbug." Perhaps that was the reason I was glad to find that the Standard Dictionary had tied shade and tree together with at least a hyphen. To me, the hyphenated word makes a much greater unification in sense and gives this useful and beautiful object a greater attribute of dignity and entity.

GLENN W. HERRICK

CORNELL UNIVERSITY

EARLY REFERENCE TO THE BLACK WIDOW SPIDER

WHAT appears to be a very early reference to the black widow spider (*Latrodectus mactans*) was printed in 1812 in "The Indian Doctor's Dispensatory, being Father Smith's Advice respecting Diseases and their Cure," by Peter Smith, of Miami County (printed by Browne and Looker, Cincinnati, Ohio, 1812; reprint, 1901, by J. U. and C. G. Lloyd, Cincinnati). On page 74, of the reprint, under No. 57, it states:

The cure of venemous Bites and Stings ought to be known, if possible, by every body; for a little delay will often render the bite or sting dreadful, and sometimes incurable. How important must it be to be able to cure

the bite or sting of serpents or spiders, especially the black spider with a red spot on his back, called the tarantula, so common and dreadful in southern climates, wasps, bees, etc.

To cure any of these, you may only wet a thimbleful of indigo with good vinegar, to make it into a mud, and apply it to the bite or sting. If done soon, the danger will be immediately over; and it is stated to me, that the place will not swell at all.

The above is a discovery lately made in Sussex county, New-Jersey, where the snake called the pilot, or copperhead, was so common and bit so many, that the mowers would scarcely venture into the meadows, until this discovery was made. They then kept some of the indigo mud by them, and found that they could cure themselves at once by this simple application.

Readers are warned not to depend upon this folk remedy, but to seek competent medical advice. However, it would be interesting to investigate, by precise laboratory methods, whether indigo acidulated with acetic acid has sufficiently marked adsorptive action on venoms to be aidful, or if other adsorbents can not be advantageously used, at least in conjunction with accepted remedial agents.

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QUOTATIONS

ABANDONMENT OF THE MOSCOW MEETING OF THE INTERNATIONAL CONGRESS OF GENETICS

THE seventh International Congress on Genetics, which was to have been held next August with a thousand of the world's leading scientists in this field participating, has been canceled by order of the Soviet Government, it is learned unofficially. Several British scientists who had expected to attend have been informed by Moscow that the congress will not be held.

About 100 Americans had been expected to attend, about forty of whom, including such authorities as Drs. C. P. Bridges, T. S. Painter, Sewall Wright and G. H. Shull, were preparing papers. A score of British geneticists had been expected, including Julian Huxley and Viscount Haldane.

An interesting story of a schism among Soviet scientists, some of the most prominent among whom are accused by Communist party authorities of holding German Fascist views on genetics and even being shielders of "Trotskyists," lies behind the cancellation. The fact that so many of the Soviet Union's most distinguished geneticists are under fire is believed to be the motive for the government's action.

In the past three months T. D. Lysenko, botanist, who has won great acclaim and high favor with the government for his experiments in the "vernalization" of wheat and other agricultural products to shorten the growing season, has been attacking the "classical geneticists" in the monthly scientific magazine, *Socialist Reconstruction of Agriculture*.

He challenged the validity of classical genetics, including the Mendelian laws and the chromosome theories and stigmatized them as "formalistic" and of no practical value, whereas his work, he said, is producing useful results. Mr. Lysenko said, "Genetics is merely an amusement, like chess or football," and he attacked the All-Union Institute of Plant Industry at Leningrad, headed by Academician N. I. Vaviloff, as useless.

Americans had a special interest in the congress because Professor Herman J. Muller, of the University of Texas, who during a four-year leave here has attracted world-wide attention with his experiments on mutations of the fruit fly, was chairman of the program committee. He is now head of the Department of Mutations and Genes of the Institute of Genetics, Academy of Sciences of the U.S.S.R. Dr. Muller is assisted here by Dr. Daniel Raffel, Johns Hopkins graduate and a nephew of Gertrude Stein.

Among Soviet geneticists now under fire are Professor S. G. Levit, head of the Medico-Genetical Institute, who was general secretary of the organization committee, for the congress, and Professor Agol, a member of the Ukrainian Academy of Sciences. Both have worked in Dr. Muller's laboratory in the University of Texas and both now have a high standing in the genetics world.

Professors Agol and Vaviloff, who have traveled extensively in America, have been arrested at Kiev on charges understood to involve Trotskyism. Professor Agol has been a Bolshevik since before the revolution. Professor Levit was originally a Menshevik, who joined the Bolshevist party in 1918.

Recently Professor Levit has come under heavy attack in the Communist party press, proving he has come under the displeasure of party authorities, who rule every phase of Soviet life, including the sciences, literature and the arts, as well as economics and politics. This has culminated in Professor Levit's being accused by the science subcommittee of the Moscow City Communist party committee of permitting the development of scientific views hostile to Soviet theory and friendly to Nazis in his institute—which was surprising in view of his published theories.

At a meeting of physicians and biologists a party representative said some Soviet scientists were not only ready to admire false and anti-scientific theories of

Nazi biologists but were imitating their methods in their own scientific work.

Now the complete mental equality of all races is as firm a dogma of Soviet faith as inequality is a dogma of Nazi faith. The party representative particularly attacked Professor Shtyvko of Professor Levit's staff for making deductions "resembling the racial nonsense of German Fascists" in a recent paper published in a German scientific journal.

Professor Shtyvko studied fifty-four skeletons of adult victims of the Russian famine during the civil war period and is alleged to have placed them somewhere between the Germans and the yellow race. He attributed this to the strain of famine and civil war.

In another paper, the party representative said, Professor Shtyvko classed the Buryat Mongols-Siberian people—as mentally equal to 12-year-old Europeans.

Professor B. I. Lavrentyeff, who was appointed chairman of a committee to look into these charges, warned Soviet medical and biological experts that they must protect Soviet science against any anti-scientific theories that might be dragged in.—*Wireless from Moscow to The New York Times.*

INTERNATIONAL CONGRESSES

THE SECOND INTERNATIONAL FORESTRY CONGRESS AT BUDAPEST

THE second International Forestry Congress took place in 1936 at Budapest, Hungary, from September 10 to 17. This was attended by 14 Americans, made up of ten foresters and four lumbermen, as follows:

Dr. F. A. Silcox, chief, and C. E. Rachford, associate chief, U. S. Forest Service; Dr. Raphael Zon, director, Lake States Forest Research Station, Minn.; John D. Guthrie, general inspector, CCC; Ovid Butler, executive secretary, American Forestry Association; Tom Gill, secretary, Pack Forestry Foundation and Educational Board; John B. Woods, forester, National Lumber Manufacturers Association; Professor Shirley Allen, Forestry Department, University of Michigan; Dr. Henry I. Baldwin, forester, Fox Research and Demonstration Forest, N. H.; Richard R. Fenska, forester, Bartlett Tree Experts, N. Y., all members of and delegates from the Society of American Foresters. The following lumbermen attended as delegates of the American Forestry Association: Ernest L. Kurth, Texas, president, National Lumber Manufacturers Association; G. F. Jewett, manager, Forest Industries, Inc., Idaho; Frank Kennett, president, Kennett Lumber Company, N. H.; and Julian F. McGowin, treasurer, W. T. Smith Lumber Company, Alabama. Nine of the above delegates were in Europe at that time on a forestry study tour under the auspices of the Oberlaender Foundation.

The idea of an international gathering or congress of foresters dates back to 1922, at the Sixth Annual General Assembly of the International Institute of Agriculture at Rome. At that time it was decided to invite all nations to a conference to consider problems in forestry, especially the world wood supply and its consumption. Following up this original suggestion, the first international forestry conference was held in Rome from April 29 to May 5, 1926. This was attended by 18 Americans, headed by Dr. S. T. Dana, dean, Forestry and Conservation Department, University of Michigan, at that time president of the Society of American Foresters.

PROMINENT NATIONALS ATTEND

Between 35 and 40 nations, colonies and dependencies were represented at the Second Congress. In addition there were delegates from five related bodies such as the International Institute of Agriculture, International Committee on Wood (C.I.B.), International Wood Gas Committee, International Travel Bureau and the International Union of Forest Research Stations. The estimated total number of delegates of various classes was 525. The heads of several of the leading forest services were present, including Sir Roy Robinson, chairman of the British Forestry Commission, Dr. E. D. Van Dissel, chief of Holland's Forest Service, Baron von Keudell, Generalforstmeister of Germany, Mons. Rene Chaplin, director general of the French Service of Forests and Waters, Dr. A. K. Cajander, director general of the Forest Service of Finland, and Dr. F. A. Silcox, chief, U. S. Forest Service.

Baron Clement Waldbott of Hungary was president of the congress, and the four vice-presidents were: von Keudell of Germany; Robinson, Great Britain; Silcox, United States, and Chaplin, France.

The congress was held under the patronage of the Regent of Hungary, Nicolas Horthy; its honorary president was Jules de Gömbös, president of the Hungarian National Council, while Minister of Agriculture Coloman de Daranyi was head of the Committee of Honor; and the co-presidents of the congress were Baron Giacomo Acerbo, president of the International Institute of Agriculture at Rome, and Dr. A. K. Cajander, director general of the Forest Service of Finland.

The congress was preceded by a ten-day field meeting of the International Union of Forest Research Stations to which Dr. Raphael Zon was the American delegate.

The number of delegates from each country to the Budapest conference varied greatly. Several countries had only one delegate, while some neighboring nations had as many as 25 or 30. Chile, Brazil and the Argentine were the only South American countries represented; there were no delegates from Canada, Mexico, Russia or Japan.

SECTIONS

Following the usual practice of scientific conferences, the congress was organized into sections as follows: I. Forest policy, economics, statistics and legislation; II. Forest management, research and education; III. Timber trade and forest products; IV. Forest utilization and industry; V. Mechanical and chemical technology of wood; VI. Silviculture and plant production; VII. Regulation of forest streams and forest and soil protection; VIII. Rural economy, nature protection, tourist recreation; IX. Tropical forestry.

The congress opened with a general meeting of all delegates. This was followed by meetings and deliberations of the 9 sections meeting simultaneously. There was a general closing session when the 32 resolutions were acted on.

In contrast to the Rome Congress of 1926, no formal reports or papers were read before the congress, printed copies of all papers having been made available to all delegates on the first day of the congress. All formal reports prepared for the congress will appear later in the *Proceedings* of the congress. The omission of the formal reading of papers at this congress was a welcome change from the 1926 Rome conference, since it greatly expedited the section meetings. Each section decided which papers, out of the large number presented, should be discussed at its sessions.

Dr. Silcox, who, among other nationals, gave an address at the opening session, was a member of the executive committee and took an active part in the deliberation of the congress. He was chairman of the American delegation, while John D. Guthrie was vice-chairman. Dr. Zon served as "rapporteur" (secretary) of the meetings of Section V, Wood Technology, and Guthrie as vice-chairman of Section II, Forest Management. French and Hungarian were the official languages, but interpreters were available at all section and general meetings, who served appreciably to break down for the Americans the barrier of a foreign language.

FIELD FORESTRY TRIPS

There were several field trips participated in by the Americans; one to Lake Balaton, the largest lake in Hungary, with its extensive summer home development, several other one-day trips about Budapest and environs, and a three-day trip to several state forests, two government tourist resort hotels (built and managed by the Hungarian Forest Service), the Hungarian Plains of Hortobagy, the cattle and horse raising region of Hungary. Here, as elsewhere, were seen considerable areas of the American black locust (*Robinia pseudoacacia*) introduced into Hungary between 1700 and 1730. A special point of interest in the Plains was the extensive areas of solid grass turf, with no evidence of overgrazing or abuse, although this region has been in continuous use by live stock for probably a thousand years.

THE SOCIAL SIDE

On the social side there was considerable activity. A formal reception to the delegates by the Regent of Hungary, Admiral Nicolas Horthy, in the Royal Palace, at which the Regent had a brief personal chat with the head of each delegation; formal dinners to the heads of the different delegations by Minister of Agriculture Daranyi, by Baron Clement Waldbott, president of the congress, and by Dr. Cajander, head of the Finnish delegation. There was also an informal joint dinner between the British and American delegates, and an informal dinner of the American and leading German delegates.

The city of Budapest proved to be of great interest to all delegates. It is a beautiful and historic city, lying on each side of the Danube, and the Hungarian foresters and officials proved to be delightful hosts.

IMPORTANT DECISIONS OF THE CONGRESS

Certain definite and important decisions were taken by the congress. Among these were:

(1) A permanent organization or international committee was set up to carry on between congresses.

(2) This is to be made up of one official or government representative from each interested nation.

(3) The permanent headquarters of this committee or permanent organization would be set up in connection with the International Institute of Agriculture at Rome.

(4) This permanent committee is to have the greatest possible autonomy in its relation to the International Institute.

(5) Annual or periodic meetings of this committee would be held not in Rome, but in the various member countries.

The present Central Organization Committee (of the second congress) will function temporarily until a permanent committee is set up. Invitations for the next congress were received from France, to be held in Paris in 1937, in connection with its International Exposition of Wood; and from Finland at Helsinki (Helsingfors) in 1940. The Permanent Committee will decide later as to the place of meeting of the next congress.

RESOLUTIONS OF THE CONGRESS

Not only because of their inherent value to foresters and other scientists, but because of the decision to set up a permanent international forestry body, in which the United States will be represented, the resolutions passed at Budapest might well be considered as signposts of international cooperation and good will. They covered a wide range of subjects in the fields of pure forestry, forest industry, control of forest damage by insects, fire, floods and overgrazing, forestation of wastelands, preservation of scenic beauty and mountain lands, forest geography, certification of forest seed, standardization of forest statistics, measurement of forest volumes and terms in phyto-sociological studies, tropical forests, etc.

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SCIENTIFIC BOOKS

MARINE ZOOGEOGRAPHY

Tiergeographie des Meeres. By SVEN EKMAN. Akademische Verlagsgesellschaft, M.B.H., 1935, Leipzig, pp. I–XII, 1–542, text figs. 1–244.

THE appearance of Sven Ekman's marine Zoogeography is of the greatest interest to all students of marine biology as well as to those interested in zoology as a whole. It is a work which has been much needed for many years, and one could hardly imagine a more satisfactory treatment of the subject. The book is equally valuable for the beginner and for the advanced worker or teacher of marine biology. It contains a wealth of facts, well selected, a clear presentation of the different theories and it is tremendously inspiring because it shows how much work there is still to be done along many lines.

The book is obviously the result of a lifelong interest in the subject, and there are probably not many so eminently fitted for doing this gigantic work as Dr. Ekman. He has had a varied experience in many fields, both as taxonomist and field ecologist; is equally at home in the well-explored waters around Sweden and in the newly discovered Antarctic seas, and he is an experienced teacher, as the logical arrangement of the material shows. The Scandinavian biological tradition and methods of attacking problems are quite evident in this book, which reviews almost two hundred years of marine research, much of which is based upon the pioneer work of the early Scandinavian workers. It is therefore very appropriate that this great milestone has been set by a countryman of Lovén, the outstanding student of marine life in Sweden, a country always famous for its good biologists.

To give a brief abstract of the contents of this book is impossible, for in spite of its 542 pages (60 of which are given over to bibliography and two indexes, one for scientific names, one for authors) the book is as condensed as an encyclopedia.

Twelve of the sixteen chapters deal with the distribution of marine shallow water invertebrates, a group hitherto sadly neglected, the last four chapters are given over to the distribution of the deepwater bottom forms and the plankton. In addition there is an excellent account of the history of marine exploration and a short epilogue about isolation and time as factors in the development of new forms.

The author treats in succession the tropical, temperate and polar waters, delimits the larger and smaller geographic areas, discusses the hydrographic conditions and the composition of the fauna, and interprets the available facts. Being himself an experienced taxonomist he has an instinct for selecting only the results of reliable, critical workers, and many groups of animals which are incompletely known or identified by persons who create landbridges promiscuously to suit their own particular need, are completely left out. The value of the *Albatross* expeditions with their wealth of material, worked out by specialists more or less affiliated with the U. S. National Museum, becomes most evident. The important conclusions regarding the relationship of the east Pacific fauna with that of the West Indies are chiefly based upon these detailed *Albatross* monographs of M. J. Rathbun, T. W. Vaughan, A. H. Clark, W. K. Fisher, J. A. Cushman, etc., to mention only a few, and their results are in turn worked in with the innumerable contributions from workers in other parts of the world. Practically every important paper dealing with marine biology is quoted, even the most recent. The book is full of refreshing original theories and new interpretations of older ones, and there is hardly a question in marine biology which the author has not touched upon. The logical arrangement of the material and the detailed indexes makes it an easy matter to find everything one wants to look up. There are very few erroneous statements (it is thus a mere slip of the pen when the author (p. 75) states that the coral genus *Acropora* is absent from the West Indies, as he expressly (p. 36) mentions that it has not been able to migrate from the West Indies to Bermuda.

That the book is written in German should not deter anybody from reading it. The vocabulary used is as simple as possible and the construction of the sentences far from involved. Moreover, the text (which in many places consists of lists of Latin names) is so

interspersed with illustrations, charts of distribution and tables with statistical data, all in the place where they rightly belong, that the meaning in most cases is quite evident. Nevertheless, it is a book which deserves to be translated into English. It takes its place next to Murray and Hjort's "The Depths of the Ocean" as one of the indispensable classics.

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SPECIAL ARTICLES

BLOOD CALCIUM IN RELATION TO ANTERIOR PITUITARY AND SEX HORMONES[1]

I

IN this study initial effort was directed to an examination of the evidence for the production by the anterior pituitary (A.P.) of a special "parathyrotropic" hormone—a hormone alleged to stimulate the parathyroids to an increased production of parathormone, which in turn is known to augment the calcium of the blood. As a contribution to this problem it was found that another, and earlier recognized, A.P. hormone is capable of increasing the serum calcium. Later, when it was further found that certain sex hormones induce marked augmentation of the serum calcium in normal, castrate, hypophysectomized or thyroidectomized animals of both sexes, equal or greater interest attached to a development of this aspect of the subject.

II

Since the existence of an A.P. "parathyrotropic" hormone is in question it was essential to examine the serum calcium-raising capacity of those A.P. hormones whose actual existence is not in question. Though this examination could not be made entirely complete the chief result, as obtained on individuals injected for six or more days, were as follows: Prolactin has no power to raise the serum calcium of normal, castrate, hypophysectomized or thyroidectomized pigeons (20 tests, 9.9 mgm per 100 cc: 10.1 mgm control) in either the fasting or non-fasting condition, nor in similar fasting rats (21 tests; 10.2 mgm; 10.1 mgm); prolactin can *decrease* this calcium (even in a shorter period than is considered here) in laying female birds. Cortin, liberated by adrenals—perhaps under the influence of prolactin—is similarly without power to increase the calcium level of such fasting pigeons (23 tests; 9.3 mgm: 9.2 mgm) and hypophysectomized rats (4 tests, 10.2 mgm: 10.0 mgm). A unique Antuitrin G preparation of the growth hormone was wholly without effect on the calcium level of three hypophysectomized pigeons; this particular preparation was shown by our assays to contain much prolactin and some thyrotropic, but to be practically free of follicle-stimulating hormone (F.S.H.). The thyrotropic hormone can not be separately tested, since such preparations invariably have been found admixed with F.S.H. Mixtures of these two hormones gave an increase of 7 per cent. (21 tests); but gonad-stimulating hormone free from thyrotropic—as found in mare serum—gave an average increase of 16 per cent. in similar hypophysectomized pigeons (14 tests) when not fasted. Larger increases are shown by normal adult females.

These results indicate that the long-recognized gonad-stimulating hormone is able—after rather prolonged and adequate dosage—to augment the blood calcium of pigeons. Before a different or a special "parathyrotropic" hormone (based on capacity to increase the calcium of the blood) can be recognized as an entity it is therefore obligatory to exclude either the presence or at least the action (indirect or secondary) of the gonad-stimulator (on sex hormone production; see below). If a second gonad-stimulating hormone, *i.e.*, a "luteinizing" hormone alone capable of stimulating sex hormone production, actually exists —and if mare serum and our own F.S.H.+ preparations from A.P. tissue all contain it—we have no evidence that would select the one or the other of those gonadotropes as the agent mobilizing calcium in these cases. We do not now know whether this gonad stimulator acts independently of, or through, the parathyroids. The possibility remains that the pituitary gland possesses another factor, or a combination of factors, which (through the parathyroids and like parathormone) augments the serum calcium more quickly than does gonadotropic hormone.

Previous work presents a confused picture. Dixon[2] injected rats with an A.P. extract (method not given) sufficient to luteinize their ovaries, found no effect on the serum calcium and suggested the gonad-stimulating hormone is not the one concerned with calcium metabolism.

III

The work of Riddle and Reinhart[3] first showed that the cyclic activity of the ovary is closely concurrent with a very great increase in the serum calcium. Their work, done on pigeons—still the animal superbly suited to this study—was later extended by many investigators to fowl, fish and toads; but in none of that work was it possible to conclude or show that the increase

[1] Aided by a grant from the Carnegie Corporation of New York. Preliminary report.

[2] F. F. Dixon, *Biochem. Jour.*, 27: 410, 1933.

[3] O. Riddle and W. H. Reinhart, *Amer. Jour. Physiol.*, 76: 660, 1926.

TABLE 1
ACTION OF VARIOUS SEX HORMONES ON SERUM CALCIUM

Sex hormone used	Animals used		Dosage		Calcium found per 100 cc serum	
	Kind	No.	Daily	No. of days	Control	Test
			r. u.		mgm	mgm
Theelin (Amniotin)	Normal ♀ doves	2	800	1	10.2	10.7
" "	Normal ♂ ♀ doves	3	40	5	10.5	12.7
" (Progynon)	Hypophysectomized ♂ pigeons	3	200	7	9.4	22.3
" "	Hypct.-castrate ♂ pigeons	2	200	7	9.0	25.1
" "	Hypct.-castrate ♂ rats	2	200	7	9.6	11.1
" "	Thyroidect.-castrate ♂ rats	3	200	7	8.9	11.4
" "	Castrate ♀ rats	2	200	14	10.0	13.1
" "	Normal dogs ♂ ♀	2	300	5	10.3	12.4
Dihydrotheelin benzoate	Hypct.-castrate ♂ pigeons	2	200	7	9.0	14.9
" (Progynon-B) "	Normal ♂ ♀ pigeons	6	200	7	10.0	14.0
" "	Castrate ♀ rats	2	200	7	10.0	10.8
Dihydrotheelin	Hypophysectomized ♂ ♀ pigeons	3	200	6	9.4	10.6
"	Castrate ♂ ♀ rats	3	375	7	10.1	10.9
Theelol (in oil)	Castrate ♂ pigeons	2	100	7	9.6	11.6
" " "	Thyroidect.-castrate rats	2	100	7	8.9	9.0
" (in H_2O)	Castrate ♂ ♀ rats	2	400	5	10.1	10.9
Progesterone	Hypophysectomized pigeons	2	1 mg	6	9.5	10.5
"	Normal ♀ rats	2	0.1 Rb. U.	10	10.7	11.6
Androstenediol	Normal adolescent pigeons	3	3.5 C. U.	7	9.8	9.8
"	Hypophysectomized pigeons	2	3.5 C. U.	7	9.3	9.3
Testosterone	Hypophysectomized ♂ pigeons	2	30 B. U.	7	9.4	9.4
Testosterone oxime	Normal ♂ ♀ pigeons	4	2 mg	7	10.1	9.9
" "	Normal ♂ ♀ rats	2	2 mg	7	10.4	10.0

of calcium was caused by the ovarian hormones which concurrently flood the body fluids of these females. Shapiro and Zwarenstein[4] obtained important data on the toad (*Xenopus*). They conclude, "It is suggested that there is evidence that the principles exerting a hormone-like action on calcium metabolism are not, in the case of the ovary, either oestrin or the luteal hormone, or in the case of the pituitary the gonadotropic hormone." Saviano[5] distinctly increased the serum calcium level in two normal dogs with theelin (progynon), and some of the various clinical applications of this hormone have indicated a like result; but both experimental and clinical results are in a confused state (review by Zwarenstein[6]).

Representative parts of our data on effects of administration of sex hormones on serum calcium, in animals fasted 20 to 24 hours, are given in Table 1. Positive results were obtained with the several species studied (doves, pigeons, fowl, rats, dogs), rabbits excepted.

With dosage prolonged to 6 or 7 days theelin is shown to have high capacity to raise the serum calcium; dihydrotheelinbenzoate ranks next in effectiveness; dihydrotheelin and theelol, in comparable dosage, have a still weaker action which is definitely positive in pigeons but not in rats. Huge doses of corpus luteum hormone (progesterone) have a slight but positive action. Twenty-five capon units of androstenediol —which otherwise shows some actions of both male and female sex hormones—was wholly devoid of calcium-raising action, even in the highly sensitive pigeon. Huge doses of testosterone, and of its oxime, are likewise wholly devoid of such action in both pigeons and rats. Though some forms of the female sex hormone are nearly or quite inert it is thus shown that the common forms of the male and female sex hormones contrast sharply and definitely in their action on calcium metabolism. We therefore now seem to have the clue to the physiological basis of a prevalent and challenging difference that has long been known to exist—namely, that the sexes differ markedly in their disposition and metabolism of calcium. This difference now appears to rest upon the circumstance that, quite automatically, females produce sex hormones which mobilize calcium (presumably from the bones; this still under study), while the sex hormones predominantly produced by males are without this action.

IV

The extent to which this disclosure assists in clarifying phenomena observed in animals and man is an intriguing, if speculative, subject. Some probable applications in physiology are evident. In medicine it should provide a somewhat surer approach to certain abnormal female states, and possibly disclose the true basis for the benefit currently derived from theelin administration in some mental cases. To students of sex difference it certainly assists a comprehension of the skeletal and mineral metabolism differences which were quite inexplicable so long as the "asexual" thyro-para-

[4] H. A. Shapiro and H. Zwarenstein, *Jour. Exper. Biol.*, 11: 267, 1934.

[5] M. Saviano, *Mem. R. Acad. Naz. Lin., Sci. Fis.*, 6: 165, 1935.

[6] H. Zwarenstein, *Biol. Reviews*, 9: 299, 1934.

thyroid apparatus and vitamin D (this latter being chemically related to the sex hormones) were the prime supervisors of the utilization and deposit of lime. Remembering the more prolonged epiphyseal growth of the bones in human castrates the anatomist and anthropologist may also give consideration to the circumstance that all the several sex cycles of females probably involve temporary interruption of calcium deposit (actual extraction?) in the bones, and perhaps thus account for a lower stature in sister than in brother; and again, they may unite this and a further fact—namely, that in some individuals and races these sex cycles begin earlier than in others—to assist, even if slightly, our understanding of the complicated problem of the statural differences of individuals and races.

V

Summary: Adequate and sufficiently prolonged administration of gonad-stimulating hormone (F.S.H. or perhaps the luteinizer) of the anterior pituitary results in an increase of serum calcium in normal, hypophysectomized or thyroidectomized pigeons; but not in castrates. This action is apparently exerted on tissues producing sex hormone or chemically related substance; the parathyroids may or may not be essential to the response. This action is obtained more quickly in females with intact ovaries than in males or in operated animals of either sex. Prolactin, cortin, F.S.H.-free "growth hormone" and probably thyrotropic do not have this action on blood calcium.

Sufficient and prolonged dosage of certain female sex hormones have great power (theelin), others notably less power (dihydrotheelin, theelol, progesterone), to increase the serum calcium in normal, castrate, hypophysectomized, thyroidectomized pigeons and rats, and in normal doves, fowl and dogs (not obtained in rabbits). Androstenediol and the male sex hormones testosterone and its oxime have no similar or demonstrable power to increase the level of calcium of the blood in these animals.

Some significant applications of the fact that male and female sex hormones contrast sharply in their action on calcium metabolism of normal and suitably operated animals are noted.

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A FIELD CONDITION RESEMBLING NUTRITIONAL ENCEPHALOMALACIA IN CHICKS

IN the course of vitamin E experiments in fowls fed a simplified but otherwise complete diet, Pappenheimer and Goettsch[1] observed a cerebellar disorder in chicks which was apparently of nutritional origin and which was characterized by ataxia and spasms, and histologically by ischemic necrosis in the affected areas. Further studies published in a series of papers culminated in the discovery by Goettsch and Pappenheimer[2] of a hitherto unrecognized protective factor against the experimental disease in certain vegetable oils.

A corresponding disorder has apparently not been recognized in the field. It is the purpose of this communication to record the occurrence of a brain disorder in chicks fed commercial rations which is indistinguishable in symptoms and in gross and histopathology from induced nutritional encephalomalacia.

The first definitely recognized case came to the writer's attention in September, 1935, in a lot of 1,200 Barred Rock chicks four weeks old which had shown symptoms of stupor during the preceding two weeks, with a mortality of 25 per cent. Recovery followed a change in feed. Since that time the disorder has been recognized in 40 specimen consignments comprising 175 chicks, 103 of which represented uncomplicated cases, 16 complicated by affections with *Eimeria tenella,* intestinal coccidiosis, non-specific ingluvitis or *Tetrameres americana;* 56 were histologically negative cases. The specimens came from an affected chick population of 49,800 having an average morbidity of 22.2 per cent. and mortality of 10.6 per cent., the mortality ranging from 0.1 to 42.8 per cent. Hearsay reports on the occurrence of this condition have also come from surrounding New England states. The disturbance was seen most frequently in Barred Rock chicks, probably due to the preference for this variety on the broiler market; it was observed also in Rhode Island and New Hampshire Reds and in White Leghorns. Comparatively large and fast-growing chicks between the ages of 14 and 59 days (average 32.5) appear to be the victims. As far as our records show, two well-known brands of feed were involved, the one 10, and the other 8 times; also home-mixed New England Conference rations, 9 times, and 8 other brands once each, making a total of 11 different feeds.

The symptoms varied from those of droopiness, as seen in the first case, to evidence of muscular incoordination, resting on the pelvic bones with a tendency to fall backwards, retraction of head, somersaults and rotation in a lateral prone position. Coarse tremor was observed occasionally in the legs. The condition was afebrile and ordinarily of rapid onset.

On gross and microscopic study of uncomplicated cases, no abnormalities could be detected in the liver,

[1] A. M. Pappenheimer and M. Goettsch, *Jour. Exp. Med.*, 53: 11, 1931.

[2] M. Goettsch and A. M. Pappenheimer, *Jour. Biol. Chem.*, 114: 673, 1936.

kidneys, proventriculus, ventriculus, intestine, sciatic nerves and beak. Occasionally the ureters were seen to be whitish, injected and slightly distended. In gross lesion cases, constituting approximately 85 per cent. of the total, the cerebellum was found enlarged, edematous, grayish and affected with minute hemorrhages around the central white matter and on the occipital surface; protracted cases sometimes showed a greenish-brown hue in the affected areas. Encephalomalacic foci were occasionally seen in the cerebrum, usually in conjunction with cerebellar lesions, but not as yet in the optical lobes. Histologic examination of etherized chicks revealed extensive pyknosis and edema in the granular layer of the cerebellum, hyaline thrombosis, hemorrhages and necrosis of the Purkinje cells, in the affected areas. Similar areas of softening without hemorrhages occurred occasionally in the cerebrum, surrounded by fat-laden macrophages. Dr. Pappenheimer kindly examined sections of our material and regarded the lesions as closely resembling those of experimental nutritional encephalomalacia.

Etiologic studies on transmissibility of the condition and attempts at cultural isolation of causative organisms have been conducted with entirely negative results. Although many field cases occurred in poorly ventilated brooder houses, and positive CO blood tests could occasionally be obtained, the condition was later observed on range, and experimentally CO-poisoned chicks did not exhibit the pathognomonic lesions. Feeding experiments with commercial brands of feed associated with which a high incidence of the disorder has been observed will form the subject of a further report.

The differential diagnosis of paralytic conditions in growing chicks to which field encephalomalacia belongs is of importance, in view of the trade practice of trying to hold either hatchery or feed concerns responsible for chick losses not directly attributable to disease factors derived from the premises. In such controversies the laboratory report is frequently made the basis of settlement. A differential scheme has been presented by the author,[3] based upon the exclusion of microbial agents and grossly recognizable conditions such as osteoporosis and perosis, followed by histologic examination of the beak, liver, kidneys, pancreas, sciatics and the brain. Of the non-microbial paralytic disorders, field encephalomalacia tallies in clinical features with the condition described by Dunlap[4] as an ataxia associated with nephritis. Pathologically it differs from the latter in the absence of kidney lesions and the presence of brain lesions. Both the nephritic ataxia and the brain disorder go under the popular term "crazy chicks"; the confusion caused by this term can readily be appreciated. The existence, however, of nephritic ataxia as an entity is doubtful; it has not been definitely observed in a large number of chicks examined histologically in this laboratory, although slight autolytic changes have been seen which to some extent simulated the alleged characteristic tubular pyknosis in the kidneys. Of other non-microbial paralytic conditions in chicks, uremia, so-called visceral gout, vitamin A[5] and vitamin G[6] deficiencies, epidemic tremor,[7] neurolymphomatosis gallinarum[8] and possibly the lack of the antihemorrhagic factor[9] have to be taken into consideration, especially in atypical cases.

A brain disorder has been observed in brooder chicks kept on commercial rations which was indistinguishable in symptomatic and histologic manifestations from nutritional encephalomalacia inducible with simplified diets. The etiology of this condition is not definitely known. The popular term "crazy chicks" is applied to it, but is confusing, as it has been linked in the literature[10] to a nephritic ataxia without brain lesions, the nature of which is uncertain. Histologic examination of certain organs is necessary for the differentiation of field encephalomalacia from other non-microbial paralytic disturbances in growing chicks.

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[3] E. Jungherr, *Poultry Sci.*, 15: 415, 1936.

[4] G. L. Dunlap, *Jour. Am. Vet. Med. Ass.*, 80: 880, 1932.

[5] O. Seifried, "Lehrgang der Histopathologie," Berlin, J. Springer, 1934.

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[7] E. E. Jones, *Jour. Exp. Med.*, 59: 781, 1934.

[8] A. M. Pappenheimer, L. C. Dunn and V. Cone, *Storrs Agr. Exp. Sta. Bul.* 143, 1926.

[9] D. Dam, *Biochem. Jour.*, 29: 1273, 1935.

[10] G. L. Dunlap, *loc. cit.*

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